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A Guide for School Administrators

Removing PCBs from Light Fixtures:

Protecting Students from Hidden Dangers

The U.S. Environmental Protection Agency (EPA) recommends removal of all pre-1979 fluorescent light ballasts in schools to prevent accidental exposure of students, teachers, and other school personnel to highly toxic polychlorinated biphenyls (PCBs) through fires or leaks. Removal of PCB-containing light fixtures, when done in conjunction with lighting upgrades, is an investment that pays off with long-term benefits to students, school staff, the community, and the environment.

The Problem: PCBs Still Prevalent in U.S. Schools

Many schools in the U.S. have light ballasts containing PCBs. The PCBs are contained within the light ballasts' capacitors and in the ballasts' potting material, which is used for insulation. Until the late 1970s, PCBs were commonly used as insulators in electrical equipment because they have high tolerance to heat, do not burn easily, and are non-explosive.

PCBs are very stable chemical compounds that do not readily break down. Because of this, they may remain in the body, causing long-lasting toxic effects over many years (see *Health Effects of PCBs*). For this reason, it is critical to minimize any potential exposure to them.

The EPA banned the manufacture and import of PCBs to the U.S. in 1979 because of their toxic effects. They also banned the processing or use of PCBs, except in totally enclosed equipment. However, no state or federal regulations precluded the continued *use* of the older PCB ballasts. Therefore, a large number of PCB ballasts are still in use in U.S. schools.

As long as the PCBs remain in the ballasts and potting material, they do not pose a health risk or environmental hazard. However, as they age, the ballasts degrade, increasing the risk of leaks or even fires, which would pose a health and environmental hazard. The hazard can be worsened by mishandling the incident. Improper cleanup of a ballast leak at a school in Oregon in 1999 potentially exposed school staff and maintenance workers to PCBs (see *What Postponing a Lighting Retrofit Could Mean,* page 5). The EPA developed this booklet and its companion piece, for school maintenance personnel, to ensure that school personnel are aware of the risks posed by PCBs in light ballasts and informed of the proper and safe way to handle fires, leaks, and retrofits.

Health Effects of PCBs

The EPA has classified all PCBs as probable human carcinogens (cancer-causing substances). Evidence suggests a possible association between PCB exposure and liver cancer. PCBs also have significant ecological and human health effects other than cancer.

The most likely way that staff may become exposed to PCBs from light ballasts is through breathing contaminated air or touching PCB oil or PCB-contaminated materials after a ballast leak or fire. No information is available on the short-term effects of PCBs in humans. However, long-term effects can occur at any time after exposure and may last for months or years. They include:

- Affects to the nervous and reproductive system, immune system suppression;
- Hormone disruption;
- Respiratory tract symptoms;
- Gastrointestinal effects;
- Mild liver effects; and
- Effects on the skin and eyes such as chloracne, skin rashes, and eye irritation.

Infants of mothers exposed to PCBs can experience developmental effects impairing movement, visual recognition memory, and short term memory. PCBs may also be passed onto infants through their pregnant or nursing mothers.

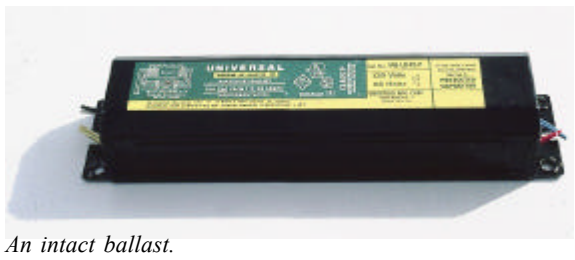
The Solution: Lighting Retrofits Remove Hazard and Improve Energy Efficiency

The EPA recommends removing PCB-containing ballasts as part of a complete lighting retrofit (see *Should Light Ballasts in Your School be Removed?*, below). A complete lighting retrofit includes removing old fluorescent tubes as well as ballasts, and replacing the *entire lighting fixture* with newer, more energy-efficient fixtures. Replacing the older ballasts with newer lighting technology improves lighting quality, distributing the light more uniformly and thus providing a more comfortable and productive learning environment. The newer lighting technology also increases energy efficiency which means cost savings for the school in the long term (see *Lighting Retrofits Get Results – Lower Energy Costs and Improved Learning Environments*, page 6, detailing how a California school benefitted from a lighting upgrade).

Lighting retrofits to eliminate PCB-containing light ballasts should be a component of any remodeling efforts. ***It is critical that the lighting upgrade be planned in sequence with other remodeling projects such as roofing, seismic bracing, and indoor air quality improvements.*** To ensure that all building code requirements are met and work is performed cost-effectively, the EPA recommends having an architect review the relationship of the lighting retrofit to other planned building improvements. Due to the hazardous nature of PCBs, only a qualified contractor should perform the lighting retrofit.

For information about proper use, storage, and disposal of PCBs, please contact your state solid and hazardous waste agency or call USEPA's information hotline at (202) 554-1404.

How Should the Old Ballasts and Fluorescent Tubes be Safely Disposed?



An intact ballast.

Safe disposal of the old ballasts and fluorescent tubes is critical. Because the ballasts contain PCBs and the fluorescent tubes contain mercury, ***the waste ballasts and tubes from a lighting retrofit should be handled as hazardous waste.***

The Toxic Substances Control Act (TSCA) regulates how PCBs, including ballasts that contain PCBs, should be disposed. All ballasts containing PCBs must be packaged in a PCB-approved container, marked properly, and shipped by an authorized PCB transporter. All *leaking* PCB-containing ballasts *must* be destroyed through high temperature incineration. TSCA allows several disposal options for non-leaking ballasts, including disposal in a hazardous waste landfill or recycling. However, many states have

Should Light Ballasts in Your School Be Removed?

Your school was built before 1979.
Your school has not had a complete lighting retrofit since 1979.

If these statements apply to your school, then the answer is most likely yes, your light ballasts probably contain PCBs and should be removed. PCB-free light ballasts manufactured after 1979 are required to have the statement "No PCBs." Any building built *before* that time is likely to have PCB-containing ballasts if it has not recently undergone a complete lighting retrofit (all light fixtures in the school were upgraded). Also, PCB-containing light ballasts were allowed to be used in fluorescent lights *after* 1979 *if* the ballasts had been manufactured before the 1979 ban. Thus, schools built *after* 1979 that have not undergone a complete lighting retrofit could have PCB-containing light ballasts in their fluorescent light fixtures as well. To determine whether your school has PCB-containing ballasts, conduct a visual inspection of a representative number of light fixtures (not just the tubes). See the companion booklet, *A Guide for School Maintenance Personnel*, for full instructions on identifying PCB ballasts.

developed special regulations for disposing of non-leaking PCB ballasts that are more stringent than TSCA. *It is critical to contact the appropriate state solid and hazardous waste agency and follow their regulations and requirements when disposing of non-leaking PCB-containing ballasts.*

When considering disposal options, factors that should be considered in determining the best option include cost, long-term environmental impacts, and long-term liability. Table 1 outlines three of the disposal options for non-leaking PCB-containing ballasts, the approximate costs, and the advantages and disadvantages. The costs of incinerating the ballasts are highest, while disposing of ballasts in a hazardous waste landfill is the lowest cost option. Recycling costs approximately $3.50 per ballast, and benefits the environment by recovering metals and reducing the volume of waste requiring burial or incineration.

Table 1: Possible Methods for Disposal of Intact PCB-Containing Light Ballasts[1]

Method	High-Temperature Incineration	Municipal, Hazardous or Chemical Waste Landfill	Recycling of Metals, High-Temperature Incineration of PCBs
Approximate Cost	$8.00 per ballast (four pounds)	$0.50 per ballast (four pounds)	$3.50 per ballast (four pounds)
Advantages	PCBs completely destroyed, removing future liability	Low cost	PCBs completely destroyed; metals recycled
Disadvantages	High cost	PCBs may seep from landfill; long-term liability	Must ensure recycling facility is permitted; long-term liability

[1]Disposal of PCB-containing ballasts is regulated federally under the Toxic Substances Control Act.

Disposal of mercury-containing fluorescent lamps is regulated under the federal Resource Conservation and Recovery Act (RCRA). Because of the high cost of testing a fluorescent lamp for mercury (approximately $140 per lamp) and the likelihood that the lamp will fail the test, the EPA recommends assuming that *all* fluorescent lamps contain mercury and handling them as hazardous waste. As with PCB-containing ballasts, it is critical to check with state solid and hazardous waste agencies to ensure the lamps are handled appropriately. As with PCBs, states have adopted stricter disposal requirements than Federal regulations. Also, some states have added mercury-containing fluorescent lamps to their universal waste rule, which allows streamlined storage, handling, and transportation requirements for specific types of waste. Contact your state or local hazardous waste program for information on proper disposal of fluorescent tubes.

Table 2: Possible Methods for Disposal of Fluorescent Tubes[2]

Method	Hazardous Waste Landfill	Recycling
Approximate Cost	$0.50 per 4-foot tube	$0.60 per 4-foot tube
Advantages	Minimal cost	Minimal cost; mercury is recovered, metals and glass are recycled
Disadvantages	Mercury may leak from the landfill; metals and glass are wasted; long-term liability	Must ensure recycling facility is permitted; long-term liability

[2]Disposal of mercury-containing fluorescent lamps is regulated federally under the Resource Conservation and Recovery Act.

Table 2 shows the two most common methods of disposing of mercury-containing fluorescent lamps, recycling or burying in a hazardous waste landfill. Although more costly, recycling recovers the mercury and removes it from the waste stream, and allows the glass and metal to be recycled. In contrast, disposal in a hazardous waste landfill results in the possibility that mercury may leak from the landfill and the lost opportunity to recover the mercury, glass, and metal.

Mercury-containing fluorescent lamps are *never* incinerated due to the potential for mercury release into the environment.

What Postponing a Lighting Retrofit Could Mean

As PCB-containing light ballasts age, the chance that they will leak or catch fire increases. This risk is compounded by the fact that there is virtually no way to detect whether ballasts are leaking or about to catch fire by simply looking at a light fixture. One school in Oregon found this out the hard way when a light ballast leaked PCB-containing oil over books, desks, and other school equipment. After the EPA become aware of this incident, they examined other light ballasts in the school and found more leaking ballasts potentially exposing students and staff to PCBs.

During the inspection, the EPA also learned that the school district was in the process of remodeling and upgrading light fixtures district-wide. Unaware that the old fixtures contained PCBs, the district had been taking them to another local school to be dismantled. The EPA discovered that the old fixtures were not being handled properly and that the leaking PCB ballasts were actually being stored on the school's playground. In addition, the workers handling the leaking ballasts were not trained in the proper handling of hazardous materials. Lack of awareness of the problem and mishandling of the response needlessly exposed students, staff, and maintenance workers to PCBs. The school district has spent more than $250,000 to clean up spilled PCBs, and is facing possible monetary penalties for improper storage and handling of PCB wastes.

Although a lighting retrofit might seem like a low educational priority in some schools when compared with new computers and classrooms, school administrators should take into account the Oregon example and what they might unexpectedly have to deal with if a ballast leaks or catches fire:

Effects on Student and Staff Health

A ballast leak or fire could happen at any time, without warning. If it happens in a busy classroom in the middle of the day, a school could be looking at long-term health impacts on many students and staff. Even a small, isolated leak may pose health issues for the staff or students who discover it. And once the leak or fire has been cleaned up and decontaminated, the school has to convince students, parents, staff, and local media that it is safe to return. Students and staff who have experienced a ballast leak or fire firsthand may be very reluctant to return to classrooms where such an incident may happen again.

Effects on Quality of Education

The affected area, classroom, hallway, cafeteria, or auditorium will be off-limits during cleanup and decontamination. It may take several weeks before the area can be declared "clean" for use again. The school will need to find appropriate temporary quarters for students and staff; many school programs and functions may be disrupted.

Response and Replacement Costs

Significant costs will be incurred to cover, at a minimum:

- Hiring properly trained and qualified cleanup personnel;
- Cleanup and decontamination of contaminated equipment and surfaces;
- Analytical testing of contaminated equipment and surfaces for PCBs as well as the more toxic furans, produced when PCBs burn;
- Compliance with environmental regulations for disposal of contaminated equipment and cleanup materials;
- Retesting of equipment and surfaces to ensure that they are free of PCBs and furans; and
- Replacement of leaking or burned fixtures and any contaminated materials, such as desks.

This ballast sparked a fire at a Southern California school in 1999.

Postponing a lighting retrofit and betting on the structural integrity of old ballasts is a dangerous gamble with serious health and educational impacts for your students and staff and serious cost impacts for your budget.

Funding to Help Finance Lighting Retrofits is Available

In most states, there are several agencies with funding available to support energy efficiency projects such as lighting retrofits. Both public utilities and private energy companies may offer such programs. Programs may include technical assistance, rebates, or other funding assistance to support lighting upgrade projects. Contact your local energy provider or state energy commission for more information.

The EPA's Energy Star program supports schools, businesses and organizations planning to install energy-efficient lighting technologies. The program offers assistance through workshops and information resources that can be accessed from the Internet. These include:

- Lighting Upgrade Technologies
- Financing Your Upgrades
- New Building Design Guidance
- Service and Product Providers

These manuals are available on the Internet at *www.energystar.gov.*

Lighting Retrofits Get Results—Lower Energy Costs and Improved Learning Environments

In 1997, the Bass Lake School District in Oakhurst, California, performed a lighting retrofit with the help of a loan program from the California Energy Commission. As a result, the schools reported a 9.25 percent decrease in energy costs in 1997, despite adding two new permanent buildings, and a further 2 percent decrease in 1998. But most importantly, the schools noted the "vastly improved learning environment provided by the new lighting system." Lighting upgrades not only increase energy efficiency and save money, they also provide a better, safer learning environment.

Although a lighting retrofit may seem to be an expensive undertaking, most retrofits pay for themselves within a surprisingly short timeframe. For example, one Southern California school with 29 classrooms and 703 students will recoup the costs of their upgrade in under seven years. The chart below outlines the upgrade and disposal costs as well as the actual funds saved through energy efficiency.

Disposal and Installation Costs

Disposal of T12 lamps (580 fixtures x 2 lamps/fixture x $0.50/lamp):	$580.00
Disposal of ballasts (580 fixtures x 1 ballast/fixture x $3.00/ballast):	$1,740.00
Installation of 580 fixtures (580 fixtures x $54.00/fixture):	$31,320.00
Total:	***$33,640.00***

Energy Savings (one year)

Electricity Demand Savings:	$4,304.00

Responding to the Public's Questions

This section is intended to help you respond to concerns expressed by students, teachers and other school staff, and parents. It provides some sample questions that may be posed and suggested answers.

Is my child in danger from PCBs in light ballasts?

As long as the PCBs in the ballasts remain in the ballasts or in the fixture, they do not pose any danger to students. The use of PCBs in magnetic light ballasts is considered an "enclosed" system. This use was not prohibited by the EPA's 1979 ban because, at the time, there was very little likelihood that the PCBs would escape their ballast containers. They are a potential danger now because the increasing age of the magnetic ballasts has greatly increased the likelihood that they may leak. This is why we are currently fitting a lighting retrofit into our overall modernization plan - to remove this potential danger as soon as possible.

Currently, students are not endangered by intact, non-leaking ballasts. Only leaking or burning ballasts are a hazard. The only way to prevent this hazard is through a complete lighting retrofit which we are planning right now.

How will you deal with a leak or fire if it happens?

The EPA has written instructions to help make school maintenance personnel become aware of these potential problems and how to handle them. This information will either be incorporated into the school's Emergency Response Plan (if the school has one) or will be used as a supplement to the plan.

Only trained professionals, such as firefighters, can respond to leaks and fires because of the hazardous substance involved. The school's role will be to evacuate the immediate area of the leak and make sure that all students and school staff maintain a safe distance to prevent any possible exposure. If there is a fire, the entire school will be evacuated until the fire has been put out. Whatever area has been affected will be off-limits to all but trained professionals until it has been cleaned up, tested, and certified to be "clean" of PCBs or other substances.

What are the health effects of PCBs?

The most likely way that students and staff may be exposed to PCBs from light ballasts is through breathing contaminated air or touching PCB oil or PCB-contaminated materials after a ballast leak or fire. As soon as we know of a leak or fire, we will immediately evacuate the area to prevent students and staff from inhaling PCB-laden air or touching the oil.

Short-term effects, which may be noticed immediately or shortly after exposure to PCBs include irritation of the eyes, nose, and throat. Short-term exposure to high levels of PCBs can damage the liver.

Long-term effects can occur at any time after exposure and may last for months or years. They include a severe, acne-like rash, called chloracne, that may persist for years; nervous system damage, causing numbness, weakness, and tingling ("pins and needles") in the arms and legs; muscle and joint pain; headaches; loss of appetite; nausea, vomiting, and abdominal pain; liver damage; reproductive effects, including still births and underweight births; and thyroid gland disorders.

The EPA has classified PCBs as probable human carcinogens (cancer-causing substances). PCB exposure may cause liver, skin, and reproductive cancers. PCBs may be passed onto infants through their pregnant or nursing mothers.

What are some of the warning signs of exposure to PCBs?

Warning signs of PCB exposure include irritation of the eyes, nose, and throat. PCB-containing oil should never be touched — any kind of skin contact constitutes overexposure.

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For More Information

For additional information about the use, storage, transportation, and disposal of PCBs, including ballasts containing PCBs, please contact the TSCA information hotline at 202-554-1404, or refer to the EPA's PCB website at *www.epa.gov/pcb*.

Notes: